Approach to reduce the limitations of modal identification in damage detection using limited field data for nondestructive structural health monitoring of a cable-stayed concrete bridge

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ABSTRACT
The objective of the study was to propose a technique to reduce the limitations of modal identification in damage detection using reduced field data for nondestructive structural health monitoring of a cable-stayed concrete bridge. Simply supported bridge models were constructed with predetermined damage at the midspan of the bridge. The technique necessitated the performance of linear and eigen analyses on the control beam and nonlinear analysis on the bridge with damage. Residuals from regression of the mode shape using the Chebyshev rational series on the modal frequencies and transformation and application into the fourth-order centered finite-divided-difference formula were shown. The use of the regressed-mode shapes for the RC bridge model showed very large residuals around the areas of the damage. The results showed that the method was successful in assisting to reduce the limitations of modal identification in locating damage on a bridge model with limited field data and was comparable to other techniques proposed by other researchers in terms of its simplicity.

KEYWORDS:
Bridge model; Chebyshev's rational series; Regression analysis; Residuals; SHM

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